US009344280B2

(12) **United States Patent**
Zhu et al.

(10) **Patent No.: US 9,344,280 B2**
(45) **Date of Patent: May 17, 2016**

(54) **SYSTEMS AND METHODS FOR AUTHENTICATING AND PROVIDING ANTI-COUNTERFEITING FEATURES FOR IMPORTANT DOCUMENTS**

(75) Inventors: **Jeffrey Zhu**, Carlsbad, CA (US); **Jun Liu**, San Diego, CA (US)

(73) Assignee: **NEOLOGY, INC.**, Poway, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 642 days.

(21) Appl. No.: **12/135,822**

(22) Filed: **Jun. 9, 2008**
(Under 37 CFR 1.47)

(65) **Prior Publication Data**

US 2010/0332838 A1 Dec. 30, 2010

Related U.S. Application Data

(60) Provisional application No. 60/942,600, filed on Jun. 7, 2007.

(51) **Int. Cl.**
H04L 9/32 (2006.01)

(52) **U.S. Cl.**
CPC ***H04L 9/3231*** (2013.01); ***H04L 9/3247*** (2013.01); *H04L 2209/60* (2013.01); *H04L 2209/805* (2013.01)

(58) **Field of Classification Search**
CPC H04L 9/3231; H04L 9/3247; H04L 2209/805; H04L 2209/60
USPC 713/176; 380/30; 726/26, 30, 32
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,872,848	A *	2/1999	Romney et al.	713/176
6,202,151	B1 *	3/2001	Musgrave et al.	713/186
6,397,334	B1 *	5/2002	Chainer et al.	713/176
6,490,680	B1 *	12/2002	Scheidt et al.	713/166
6,553,494	B1 *	4/2003	Glass	713/186
6,819,219	B1 *	11/2004	Bolle et al.	340/5.52
7,170,391	B2 *	1/2007	Lane et al.	340/5.82
2005/0010776	A1 *	1/2005	Kenen et al.	713/176
2006/0174353	A1 *	8/2006	Ryal	726/31
2006/0206714	A1 *	9/2006	Gubo	713/176

(Continued)

FOREIGN PATENT DOCUMENTS

GB	2391988	A *	2/2004
WO	WO 2006069611	A2 *	7/2006

OTHER PUBLICATIONS

Pim Tuyls and Lejla Batina, "RFID-Tags for Anti-counterfeiting", Topics in Cryptology—CT-RSA 2006 Lecture Notes in Computer Science, 2006, vol. 3860/2006, 115-131. [retrieved from SpringerLink database on Sep. 26, 2011].*

Juels, A.; Molnar, D.; Wagner, D.;"Security and Privacy Issues in E-passports"; Security and Privacy for Emerging Areas in Communications Networks, 2005. SecureComm 2005. First International Conference on; Sep. 5-9, 2005; pp. 74-88 [retrieved from IEEE database on Sep. 26, 2011].*

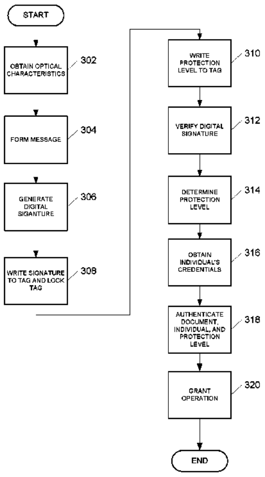
(Continued)

Primary Examiner — Saleh Najjar
Assistant Examiner — Louis Teng
(74) *Attorney, Agent, or Firm* — Procopio, Cory, Hargreaves & Savitch, LLP; Noel C. Gillespie

(57) **ABSTRACT**

A method for authenticating a document comprises obtaining the contents of a document, obtaining biometric characteristics from an individual, forming a message based on the contents of the document and the biometric characteristics of the individual, generating a digital signature based on the message and a key, and writing the digital signature to an Radio Frequency Identification (RFID) tag affixed to the document.

28 Claims, 3 Drawing Sheets


START
OBTAIN OPTICAL CHARACTERISTICS
302
FORM MESSAGE
304
GENERATE DIGITAL SIGANTURE
306
WRITE SIGNATURE TO TAG AND LOCK TAG
308
WRITE PROTECTION LEVEL TO TAG
310
VERIFY DIGITAL SIGNATURE
312
DETERMINE PROTECTION LEVEL
314
OBTAIN INDIVIDUAL'S CREDENTIALS
316
AUTHENTICATE DOCUMENT, INDIVIDUAL, AND PROTECTION LEVEL
318
GRANT OPERATION
320
END

(56) References Cited

U.S. PATENT DOCUMENTS

2006/0282672	A1 *	12/2006	Sanchez et al.	713/176
2007/0056041	A1 *	3/2007	Goodman	726/26
2007/0078559	A1 *	4/2007	Rosen	700/220
2007/0102920	A1 *	5/2007	Bi et al.	283/72
2007/0206248	A1 *	9/2007	Winterbottom et al.	359/2
2009/0232346	A1 *	9/2009	Zilch	382/100

OTHER PUBLICATIONS

Machine Readable Travel Documents part 1 ICAO Doc 9303, 2006.*

Machine Readable Travel Documents Technical Report: PKI for Machine Readable Travel Documents offering ICC Read-Only Access v1.1 Oct. 1, 2004.*

* cited by examiner

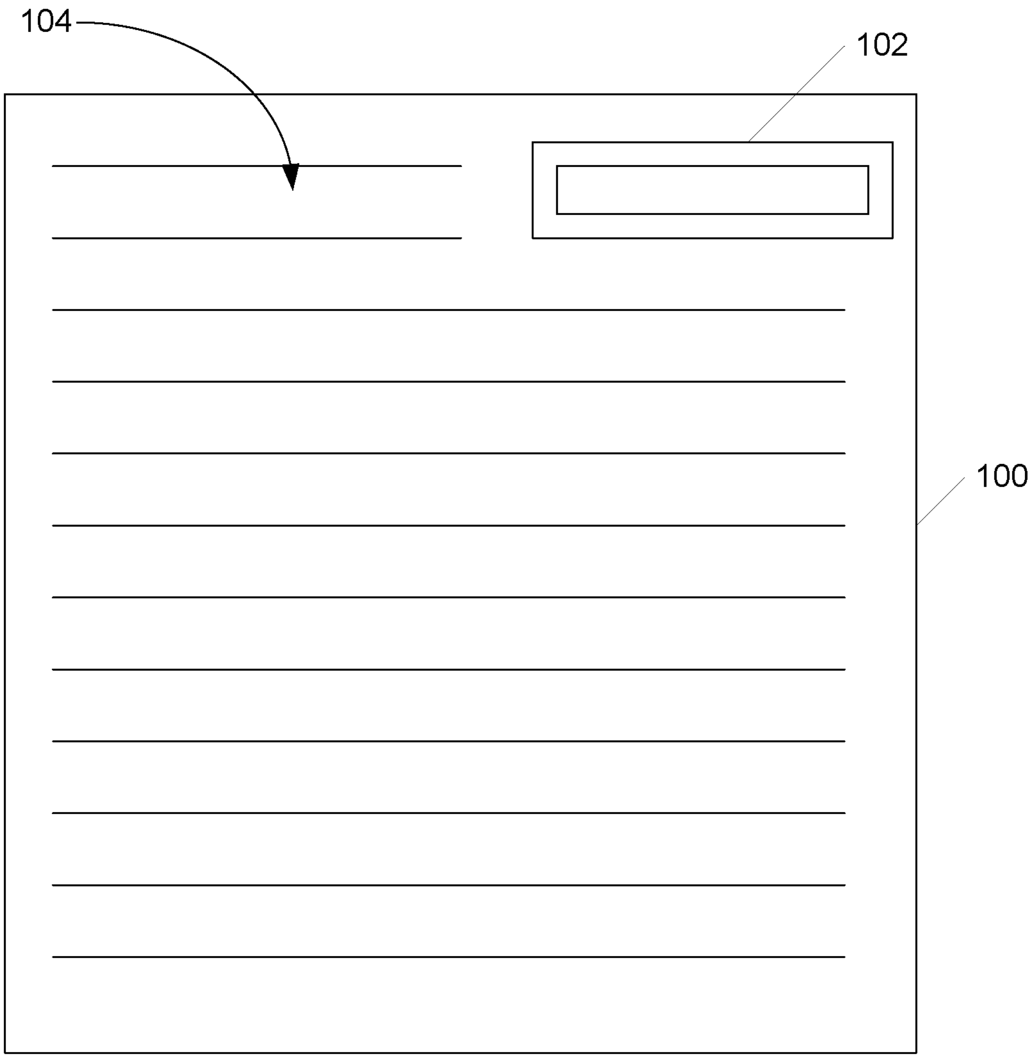


FIG. 1

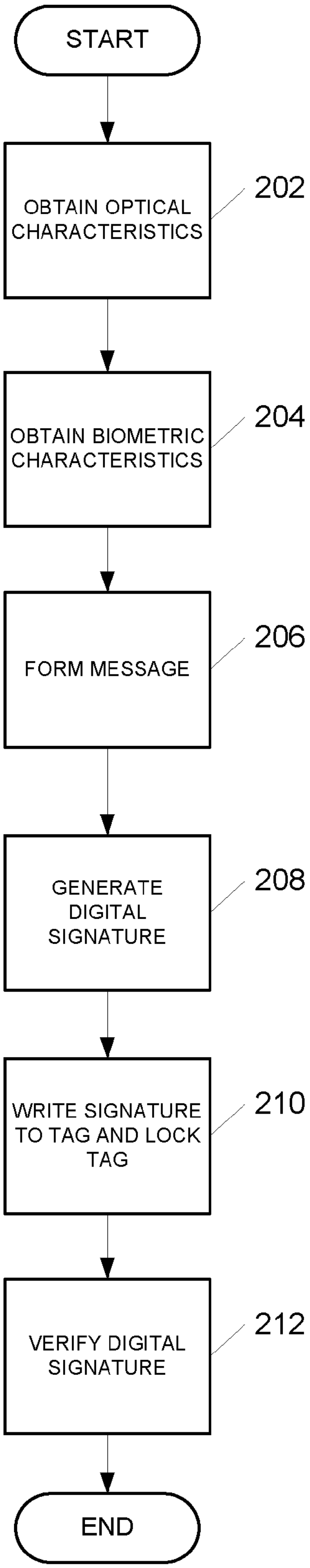

START
OBTAIN OPTICAL CHARACTERISTICS
202
OBTAIN BIOMETRIC CHARACTERISTICS
204
FORM MESSAGE
206
GENERATE DIGITAL SIGNATURE
208
WRITE SIGNATURE TO TAG AND LOCK TAG
210
VERIFY DIGITAL SIGNATURE
212
END

FIG. 2

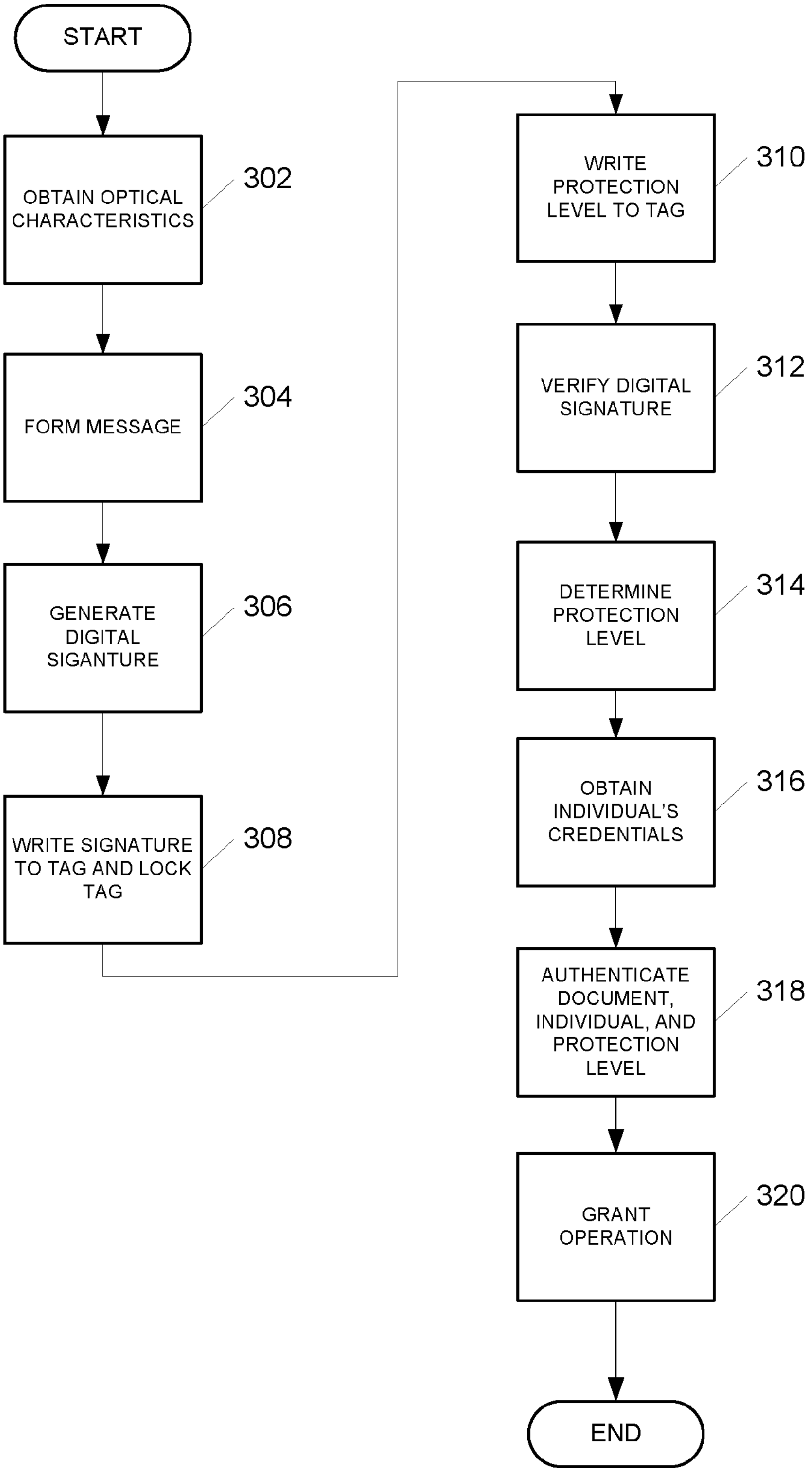

START
OBTAIN OPTICAL CHARACTERISTICS
302
FORM MESSAGE
304
GENERATE DIGITAL SIGANTURE
306
WRITE SIGNATURE TO TAG AND LOCK TAG
308
WRITE PROTECTION LEVEL TO TAG
310
VERIFY DIGITAL SIGNATURE
312
DETERMINE PROTECTION LEVEL
314
OBTAIN INDIVIDUAL'S CREDENTIALS
316
AUTHENTICATE DOCUMENT, INDIVIDUAL, AND PROTECTION LEVEL
318
GRANT OPERATION
320
END

FIG. 3

SYSTEMS AND METHODS FOR AUTHENTICATING AND PROVIDING ANTI-COUNTERFEITING FEATURES FOR IMPORTANT DOCUMENTS

RELATED APPLICATIONS INFORMATION

This application claims priority under 35 U.S.C. 119(e) to U.S. Provisional Patent Application Ser. No. 60/942,600, entitled "SYSTEMS AND METHODS FOR AUTHENTICATING AND PROVIDING ANTI-COUNTERFEITING FEATURES FOR IMPORTANT DOCUMENTS", filed Jun. 7, 2007, which is incorporated herein in its entirety as if set forth in full.

BACKGROUND INFORMATION

1. Technical Field

The embodiments described herein relate to document information leakage, authentication and anti-counterfeiting, and more particularly to the use of Radio Frequency Identification (RFID) technology to ensure that documents are authentic and cannot be copied without permission.

2. Related Art

There are several known techniques for ensuring the authenticity and preventing anti-counterfeiting of various documents. For example, special inks, holographs, special papers, etc., have been used to ensure that documents are authentic and cannot be counterfeited.

Digital signature schemes have also been developed in order to increase the security of important documents. A digital signature scheme is a type of asymmetric cryptography used to simulate the security properties of a signature in digital rather than written form. A digital signature scheme normally has two algorithms, one for signing, which involves the use of a secret or private key, and one for verifying the digital signature, which involves the use of a public key. It is the output of the signing algorithm using the private key that is referred to as the digital signature. Thus, digital signatures can be used to authenticate the associated input (i.e., message) to the signing algorithm. The message can be anything from an electronic document, an email, digitize-able characteristics of physical object or a physical contract or document.

A digital certificate can contain the sender's public key as well as other information. The digital certificate and digital signature can both be transmitted to a receiver so that the receiver can verify the signature using the sender's public key. In a conventional public key infrastructure, there is a Certificate Authority (CA) to issue, distribute, and authenticate digital certificates so that senders and receivers can rely on the CA.

SUMMARY

Systems and methods that allow for the authentication and anti-counterfeiting of important documents are described herein.

According to one aspect, A method for authenticating a document comprises obtaining the contents of a document, obtaining biometric characteristics from an individual, forming a message based on the contents of the document and the biometric characteristics of the individual, generating a digital signature based on the message and a key, and writing the digital signature to an Radio Frequency Identification (RFID) tag affixed to the document.

According to one aspect, a method for generating a digital certificate can comprise obtaining optical characteristics of a document, obtaining biometric characteristics from an individual, forming a message, generating a digital signature, writing the digital signature to an Radio Frequency Identification (RFID) tag, locking the RFID tag, and verifying the digital signature.

According to another aspect, A method for controlling access to a document comprises obtaining the contents of a document, obtaining biometric characteristics from an individual, forming a message based on the contents of the document and the biometric characteristics of the individual, generating a digital signature based on the message and a key, determining a protection level for the document, writing the digital signature and the protection level into an RFID tag affixed to the document, reading the digital signature and the protection level out of the RFID tag, obtaining an individuals credentials, authenticating the digital signature using a key, authenticating the individual's credentials, and granting access to the document based on the protection level and the authentication of the credentials.

According to still another embodiment, a system for generating a digital certificate comprises a document containing information, and an RFID tag affixed to the document, the RFID tag configured to store a digital signature formed from the contents of the document and a key.

According to another embodiment, a system for generating a digital certificate comprises a document containing information, and an optical memory affixed to the document, the optical memory configured to store a digital signature formed from the contents of the document and a key, and an RFID tag affixed to the document, the RFID tag configured to store a key used to verify the signature.

These and other features, aspects, and embodiments are described below in the section entitled "Detailed Description."

BRIEF DESCRIPTION OF THE DRAWINGS

Features, aspects, and embodiments are described in conjunction with the attached drawings, in which:

FIG. **1** is a diagram showing a document according to one embodiment described herein.

FIG. **2** is a flowchart illustrating a method for providing document authentication according to one embodiment described herein.

FIG. **3** is a flowchart illustrating a method for anti-counterfeiting of a document according to one embodiment described herein.

DETAILED DESCRIPTION

FIG. **1** is a diagram illustrating a document **100** the contents of which can be protected using the systems and methods described herein. Referring to FIG. **1**, information can be stored on Radio Frequency Identification (RFID) label **102** (also referred herein as an RFID tag) and can be used to authenticate the document **100**.

A digital signature can be generated and can be written into an RFID tag, or a label that can be affixed to the document **100**. The digital signature can then be read out and verified in order to provide authentication, anti-counterfeiting, and even privacy capabilities. The digital signature can be signed upon the message that can be based on a combination of the contents of the document, the optical characteristics of the document, biometric characteristics of the owner of the document, or a person transporting or handling the document, or a person wishing to read or copy the document.

The digital signature can be written into the RFID tag using e.g., a proprietary writing scheme or key exchange scheme and the RFID tag memory can be locked in order to prevent someone from altering the contents of the RFID memory. Further, the RFID tag can be a tamper-proof tag such that if the RFID tag is removed from the document, it will damage the RFID tag and prevent it from being read in the future. The systems and methods described herein can be used, e.g., on ID cards, passports, licenses, birth certificates, and other high valued certificates and documents.

FIG. **2** is a flowchart illustrating a method for providing document authentication according to one embodiment described herein. Referring to FIG. **2** and FIG. **1**, in one embodiment, this method can, for instance, be used to authenticate document **100** using information that can be stored in RFID label **102**. Additionally, certain optical characteristics of document **100** can be obtained and used as part of the message.

According to one embodiment, all of the text **104** of document **100** can be scanned and used as the message for generating the digital signature. In other embodiments, only certain letters within text **104** can be used in order to generate the message, for use in generating the digital signature. For example, the first letter of every line, the first word of every sentence, or certain strategically selected words or letters, e.g., that themselves form a secret word or message, can be extracted from text section **104** and used to form the message.

Alternatively, certain portions of text **104** can be printed in special inks and only the text printed in these special inks can be used to form the message for use to generating the digital signature. For example, invisible ink, e.g., only visible using an ultra violet light, can be used to print portions of text **104**. This invisible portion of text **104** can be used to form the message. Alternatively, portions of text **104** can be printed in a graded pattern of security print and these portions of text **104** can be used to form the message used to generate the digital signature.

As illustrated in step **204**, certain biometric information can also be obtained and used to form part of the message. Biometric information can include fingerprint information, face scan information, iris pattern or eye scan information, etc. The biometric information can be read by a reader and input into a computer along with the optical characteristics in order to generate the message. The biometric information can belong to, e.g., the author, or owner of document **100** or the person carrying document **100**.

In step **206**, the optical characteristics and biometric information can be turned into a message that can be used to generate the digital signature in step **208**, e.g., using public/private key technology (i.e. signed by a private key). In step **210**, the digital signature can be written into RFID label **102**, e.g., using a proprietary writing scheme. As mentioned above, the memory of RFID label **102** can then be locked in order to prevent tampering with the data written in the RFID tag **102**. Further, RFID tag **102**, can itself, be a tamper-proof tag, such that if the tag is pulled off or physically tampered with, it will not be capable of being read in the future, the original document will be left with evidence of tampering.

In order to authenticate document **100**, the digital signature can be read out of RFID label **102** in step **212**, and verified, e.g., using public/private key technology. At the same time, the optical characteristics of document **104**, and/or the biometric information obtained in step **204**, can also be verified. In this manner, the authenticity of the document, as well as the identity of the author/owner or carrier can both be verified.

The key used to verify the digital signature in RFID tag **102** can be stored in, e.g., a special ink, security print, hologram, micro-print, optical memory, or bar code label, which can also be affixed to or included with the document **100**. Thus, the user may need to be at a specific station, which can be configured to read the key in order to verify the signature contained in the RFID tag **102**. The key for signature verification is the public key when the public/private key technology is used. One benefit to this method is that no CA or distribution system is required to issue or authenticate digital certificates (i.e. public keys) because a public key can be carried with the document itself in various means, for instance, but not limited to those described above.

FIG. **3** is a flowchart illustrating a method for anti-counterfeiting of a document **100**, according to one embodiment described herein. As with the method described with respect to FIG. **2**, the method with respect to FIG. **3** can begin in step **302** by obtaining the optical characteristics of the document at issue. These optical characteristics can then be turned into a message in step **304**, which can be used to form a digital signature in step **306**. The digital signature can then be written into RFID label **102** in step **308**. Additionally, a protection level can also be written into RFID label **102** in step **310**. The protection level can indicate a level of access and specify who can access the document. For example, in one embodiment, the protection level can indicate a document status such as "read-only", or "not read-only," which can indicate whether the document can be copied. In other embodiments, a class of people can be given certain rights. For example, the protection level could indicate that the document can be read by the public but not copied, or copied by certain individuals (e.g., a supervisor, etc), or multiple levels of protection based on the authentication used to make the document readable.

Reading or copying stations can then be equipped with special lighting features, e.g., in order to read various inks used to produce texts portion **104**, an RFID reader in order to read label **102**, and a biometric scanner, e.g., a fingerprint scanner, face scanner, iris scanner, etc., in order to verify the identify of a person using the reading or copying station. Thus, in step **312**, if someone wishes to read or copy document **100** using the reading or copying station, the digital signature can be read out of tag **102** and verified. In step **314**, the protection level can be read and in step **316**, the individual's credentials, i.e., biometric information, can be read or scanned. In step **318**, the station can authenticate the document, the individual, and the protection level before allowing the individual to proceed in step **320** where the operation (e.g. read message content) is granted.

For example, if the individual is trying to copy the document, then a copier can be configured to stay inactive until the authentications of step **318** are achieved. After successful authentication in step **318**, the copier would turned on and the individual be allowed to make a copy. It should be noted, that the copier might need to be equipped with special lighting features in order to make certain portions of text **104** capable of being copied. Similarly, if the station is a reading station, then once the verifications of step **318** are carried out, the individual could be allowed to read the document which can comprise activating special lighting features in order to make text portion **104** visible.

Further methods for ensuring the authenticity of information or items are described in detail in U.S. patent application Ser. No. 11/270,067, entitled "Systems and Methods for Tracking Containers," filed Nov. 9, 2005, and incorporated herein by reference as if set forth in full. Methods for using biometric information to ensure secure authentication of information are described in detail in U.S. patent application Ser. No. 11/29,912, entitled 'System and Method for Providing Secure Identification Solutions," filed Apr. 17, 2006, which is also incorporated herein as if set forth in full.

While certain embodiments have been described above, it will be understood that the embodiments described are by way of example only. Accordingly, the systems and methods described herein should not be limited based on the described embodiments. Rather, the systems and methods described herein should only be limited in light of the claims that follow when taken in conjunction with the above description and accompanying drawings.

What is claimed is:

1. A method for authenticating a document, comprising:

obtaining optical character recognition (OCR) characteristics of contents of the document, wherein the contents of the document comprise at least a portion of text from the document;

obtaining, separate from the document, biometric characteristics from an individual authorized to access the document;

forming a message based on the OCR characteristics of the contents of the document and the separately obtained biometric characteristics of the individual authorized to access the document;

generating a digital signature based on the message and a key;

writing the digital signature to a radio frequency identification (RFID) tag affixed to the document;

in response to an attempt to copy the document, reading the digital signature from the RFID tag;

verifying an individual attempting to copy the document based on one or more biometric characteristics collected from the individual attempting to access the document and at least a portion of the biometric characteristics of the individual authorized to access the document included in the message comprising the digital signature; and

in response to successfully verifying the individual attempting to copy the document, granting the individual copy access to the document by activating a lighting feature comprising a copier that allows the copier to copy at least a portion of the contents of the document.

2. The method of claim **1**, wherein the text from the document includes all of the text contained within the document.

3. The method of claim **1**, wherein the text from the document includes only certain words contained within the document.

4. The method of claim **1**, wherein the text from the document includes only certain letters or symbols contained within the document.

5. The method of claim **1**, wherein at least a portion of the contents of the document is rendered in a special ink that cannot be copied without the lighting feature.

6. The method of claim **1**, wherein the text from the document includes a security print.

7. The method of claim **1**, wherein the text from the document includes a micro-print.

8. The method of claim **1**, further comprising reading the digital signature out of the RFID tag and verifying the digital signature using a key.

9. The method of claim **8**, further comprising obtaining the key used to verify the digital signature from a hologram included in the document.

10. The method of claim **8**, further comprising obtaining the key used to verify the digital signature from an optical memory attached to the document.

11. The method of claim **8**, further comprising obtaining the key used to verify the digital signature from a bar code attached to the document.

12. The method of claim **1**, further comprising locking the RFID tag after the digital signature is written thereto.

13. The method of claim **1**, further comprising obtaining, separate from the document, biometric characteristics from an holder or owner of the document, and wherein the message is further formed based on the biometric characteristics of the holder or owner of the document.

14. The method of claim **1**, further comprising:

determining a protection level for the individual with respect to the document, wherein the protection level corresponds to one or more authorized access levels associated with the individual;

verifying whether copy access corresponds to one of the one or more authorized access levels associated with the individual; and

granting the individual copy access to the document further in response to successfully verifying that copy access corresponds to one of the one or more authorized access levels associated with the individual.

15. A method for authenticating a document and for controlling access to said document, the method comprising:

obtaining optical character recognition (OCR) characteristics of contents of the document, wherein the contents of the document comprise text from the document;

obtaining, separate from the document, biometric characteristics from an individual authorized to access the document;

forming a message based on the OCR characteristics of the contents of the document and the separately obtained biometric characteristics of the individual authorized one or more levels of access to the document;

generating a digital signature based on the message and a key;

writing the digital signature to a radio frequency identification (RFID) tag affixed to the document;

in response to an attempt to read the document, reading the digital signature from the RFID tag;

verifying an individual attempting to read the document based on one or more biometric characteristics collected from the individual and at least a portion of the biometric characteristics of the individual having authorized access to the document included in the message comprising the digital signature;

in response to successfully verifying the individual attempting to read the document, granting the individual read access to the document by activating a lighting feature that renders at least a portion of the contents visible.

16. The method of claim **15**, wherein the text from the document includes all of the text contained within the document.

17. The method of claim **15**, wherein the text from the document includes only certain words contained within the document.

18. The method of claim **15**, wherein the text from the document includes only certain letters or symbols contained within the document.

19. The method of claim **15**, wherein at least a portion of the contents of the document is rendered in a special ink that is invisible without the lighting feature.

20. The method of claim **15**, wherein the text from the document includes a security print.

21. The method of claim **15**, wherein text from the document includes a micro-print.

22. The method of claim **15**, further comprising obtaining the key used to verify the digital signature from a hologram included in the document.

23. The method of claim **15**, further comprising obtaining the key used to verify the digital signature from an optical memory attached to the document.

24. The method of claim **15**, further comprising obtaining the key used to verify the digital signature from a bar code attached to the document.

25. The method of claim **15**, further comprising locking the RFID tag after the digital signature is written thereto.

26. The method of claim **15**, wherein obtaining the individual's credentials comprise obtaining biometric information of the individual.

27. The method of claim **15**, further comprising obtaining, separate from the document, biometric characteristics from an holder or owner of the document, and wherein the message is further formed based on the biometric characteristics of the holder or owner of the document.

28. The method of claim **15**, further comprising:

determining a protection level for the individual with respect to the document, wherein the protection level corresponds to one or more authorized access levels associated with the individual;

verifying whether copy access corresponds to one of the one or more authorized access levels associated with the individual; and

granting the individual read access to the document further in response to successfully verifying that read access corresponds to one of the one or more authorized access levels associated with the individual.

* * * * *